Light and Lighting

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Edited by J. STEWART DOW

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	Page
Editorial Notes ...	95
Notes and News ...	96
Twenty-Four Hours "Daylight"... ...	98
Lighting in the Aircraft Industry ...	100
Traffic Control in the Black-Out ...	104
The "Dimout" in U.S.A.	105
The Editor Replies ...	108
Lighting Literature ...	110

Oh Yeah? No—Yes!

IT was well said recently (by Priestley, was it not?) that the course of events in this country during the critical years preceding the war, and perhaps the fate of all Europe, might have been very different if there had been less disposition to greet new ideas with a cynical "Oh Yeah?" and more disposition to greet them with an enthusiastic "*Yes!*"

There is a lesson here for the future. In thinking of Reconstruction, and particularly of the part to be played by lighting therein, let us not too readily assume that the limits of economics, the barriers of conservatism, and the perversity of animate and inanimate things will defeat our aspirations.

Let us rather say, with Clough, "If hopes are dupes, fears may be liars," and with Browning, "Greet the Unseen with a Cheer," believing firmly in our mission and confident in our power to fulfil it.

Protective Lighting

A good illustrated account has been given by Mr. Cyril Ainsworth, who is the acting chairman of the American War Committee on Protective Lighting of Industrial Properties, of the conditions of lighting being applied in the U.S.A. to defeat sabotage.* Such installations usually take the form of floodlighting, by means of projectors mounted on towers, of all the surrounding area and approaches to important national works. All possible means of concealment (bushes, etc.) are removed wherever possible over such areas. A series of ten requirements essential to determine efficiency are mentioned. Minimum levels of illumination are recommended (though these must be kept distinct from values requisite for carrying out of work by night). U.S.A. specifications for protective lighting are divided into two parts dealing respectively with boundaries and approaches and with areas as between definite property lines, either fenced or unfenced. Mr. Ainsworth points out that protective lighting and dim-out lighting are necessarily in conflict, so that in dim-out areas the advice of the authorities must be sought. Control of protective lighting, enabling it to be either extinguished or increased in emergency, is desirable. Protective lighting is, however, obviously difficult to apply in countries where a rigid black-out has been found necessary.

* "Correct Lighting Protects Against Sabotage," by Cyril Ainsworth. (*Industrial Standardisation*, February, 1943, p. 56.)

The Place of Scientists in the Community

There is justice in the plea that scientific effort, so valuable in time of war, shall be applied to the serious problems of reconstruction that will follow. A letter signed by the chairman of the Joint Council of Professional Scientists and the presidents of the Royal Institute of Chemistry and the Institute of Physics endorses this view. But it also makes two excellent points—one apt to be overlooked by the general public, the other by scientists themselves. It is sometimes said that if some fraction of the national income were allocated to scientific research, and if men of science were given a position of authority in the affairs of the State, the community would find itself in "an age of plenty." In actual fact the fruits of research sometimes ripen slowly. Because of this time-lag immediate preparations for the application of science to reconstruction should be made. Next, it is remarked, the claim that the scientist, *as scientist*, should be in some position of exceptional authority in deciding the policies of Governments is one that cannot be accepted in a democratic community. The man of science could profitably be consulted more frequently than has been the case. When, however, his advance has been given this duty, as a scientist he is at an end." "A scientific and soulless technocracy would be the worse form of despotism." We agree —and yet one could wish that those in authority had a little more of the scientific outlook.

R.I.B.A. Lectures on Illumination

Readers will have observed the enterprising arrangements made by the Royal Institute of British Architects for lectures on special subjects, including lighting, during the present year. On January 23 Mr. R. O. Ackerley and Mr. W. Allen lectured respectively on artificial and natural lighting, and these subjects were again considered on May 15. On that occasion there were three lectures. The opening address by Mr. H. C.. Weston was devoted to a review of the conditions determining the need for good lighting in relation to health and efficiency. Mr. P. V. Burnett and Mr. R. O. Ackerley, who followed, dealt with the practical problems involved in the provision of good natural and artificial lighting, the former explaining the "Daylight Factor" and describing processes for determining access of daylight into buildings, whilst Mr. Ackerley explained how predetermination to artificial lighting can be made.

There is a pleasant informality about these meetings, and, although it seemed to be somewhat bold to arrange them on Saturday afternoons, there have, it is understood, been keen and fairly numerous audiences. The R.I.B.A. are to be congratulated on thus bringing lighting problems to the attention of architects, in whose hands the provision of good natural and artificial lighting so largely rests.

Traffic Signals

"Half Moons" in London

A great benefit has been conferred on the London traffic by the adoption of arrangements enabling the lower half of each traffic signal to be unobscured during daylight hours, furnishing a luminous "half moon" instead of the thin cross. The changeover is effected by the police every night and morning. This imposes some extra labour, but there can be no question of the value of the change, which we believe was urged by the I.E.S. many months ago. It has long been a matter of common knowledge that the "cross signal," whilst perhaps adequate at night, is most difficult to distinguish by day, especially in bright sunshine. All motorists will hail the concession with great relief, and pedestrians (to whom the "cross" signal was often still less visible) will be even more grateful. We hope that the arrangement will be extended in due course to other cities.

I.E.S. Papers: Session 1943-44

We are asked to remind I.E.S. members once more that *this* is the time when preparations for the 1943-44 session are necessarily made. The hon. secretary will be glad to receive offers of papers for sessional meetings in London or suggestions in regard to topics for discussion. Suggestions in regard to subject matter for meetings of centres and groups will also be welcome, and should be addressed to the secretaries concerned.

Representatives Required

Prominent manufacturers of industrial and public lighting equipment, domestic appliances, etc., require additional representatives for London and Lancashire, particularly for industrial lighting. Electrical knowledge and lighting experience an advantage, but applications from progressive, adaptable young men, exempt from military service, fully considered. State age, qualifications (particularly education), and salary required, in confidence. Applications also invited for other territories where augmented representation is contemplated. Box No. 100.

Engineering Twenty-Four Hours' Daylight

The address reviewed below was recently delivered by Mr. C. F. Prideaux at a joint meeting of the American I.E.S. and the American Institute of Electrical Engineers, and appears in *Illuminating Engineering* (May, 1943, p.227). It contains an interesting survey of industrial lighting conditions in America where, in thousands of plants, it has been necessary to provide the practical equivalent of daylight for twenty-four hours a day.

In introducing his subject Mr. Prideaux remarked that the whole war effort was of necessity based upon round-the-clock operation in all critical industries. The need for this continuous effort, coupled with the blacking-out in factories throughout coastal defence areas, strongly emphasised the need for adequate lighting. In a sense the safety and effectiveness of the armed forces depend upon accurate seeing on the part of operators.

Twenty-four Hour Daylight

Industry has approached the problem of illumination with willingness to improve seeing by every available means. Side walls and ceilings have been painted to ensure efficient utilisation of the ill-light installed. In new plants light-reflecting materials, many of which do not require painting, have been used. In plants dealing with the production and assembly of large equipment, requiring extensive work on the under-side of units in production, white cement floors have proved highly effective in reflecting light on to surfaces from which direct illumination is blocked. Fluorescent lighting has been a great boon, making it possible to provide high-level illumination without glare. Its relatively low heat output has also resulted in a substantial reduction in the amount of refrigeration required for air conditioning.

The author next referred to "the perpetual question," how much more it costs to light a windowless building than an identical structure designed for daylight. He mentions two recently completed plants—one blacked-out completely, the other taking full advantage of daylight design—in which practically identical lighting conditions, furnishing 35-40 ft.-c., have been provided. A comparative study of these plants should prove highly informative.

Windowless Factories

In the meantime the conception of the windowless factory has been gaining ground owing to the recognised advantage of securing complete independence of variable outside conditions of light, temperature, and humidity. As one instance, the author describes a single five-acre windowless room of the Simond's organisation, with its accurate control of sound, atmosphere, and light, and the special planning of industrial operations rendered possible by this control. He likewise mentions the Allison Engine Plant of General Motors Corporation, where, so long ago as 1939 (before there was any thought of black-out precautions in the United States), "controlled conditions design" was adopted. This decision was based upon the necessity for atmosphere control in order to ensure accurate mass production of engines. It was found that parts finished from metal which had absorbed the radiant heat of sunlight could but conform to the exacting tolerances if machined in the expanded state. Daylight had, therefore, to be shut out and temperature and humidity to be under accurate control.

Experience in the Simond's Plant

A quotation from a letter written this year by the Simond's plant engineer contains interesting details of the performances of lamps, illumination, maintenance and output. The fluorescent

lamps now have an average life of 4,800 hours, as compared with 3,400-3,800 when originally installed in 1939, and cost two dollars apiece, as compared with six dollars initially. The "daylight white" colour now adopted is preferred to the original "blue-white." By washing reflectors and lamps every six months illumination is maintained almost constant at 25 ft.-c. The number of employees has risen from 750 in 1939 to more than 1,500 to-day. The plant has operated continuously for twenty-four hours a day and for seven days a week during 1942, with short pauses for holidays. The number of days lost per thousand man-hours dropped from 0.93 in 1940 to 0.54 in 1941 and 0.51 in 1942. Lost time from sickness has steadily diminished. During local epidemics of colds, influenza, etc., the proportion affected amongst factory workers was 25 per cent. below that for outsiders. The uniformity of conditions makes it easier to man the second and third shifts, and production and spoilage do not vary with the shifts. Machines are painted in orange yellow and furnace equipment in aluminium. The reflected light aids vision, and equipment is kept cleaner and in better shape owing to the light colours.

Illumination Almost Independent of Height

Numerous other plants furnished with illuminations of the order of 40 ft.-c. are mentioned. Of special interest is one operated by Consolidated Aircraft Production, a windowless air-conditioned structure with a floor of white cement, extending two-thirds of a mile in its 100-ft. assembly bay. More than 20,000 fluorescent units, mounted 40 ft. high and spaced on trusses 25 ft. apart, are used. A notable point is that much of the assembly work is done on elevated platforms as high as 18 ft. above the floor. It is interesting to learn that the illumination from floor level up to this 18-ft. level remains almost constant, near 40 ft.-c., the variation being only 8 per cent. directly under trusses and 5 per cent. between trusses. Tests have shown an average illumination in a vertical plane of near 20 ft.-c.

A Formidable Maintenance Problem

The maintenance of the large number of lighting units, over 20,000, is naturally something of a problem, in view of the fact that the service must operate continuously. Work is done from an interconnecting monorail system by means of a special platform accommodating five men. The bay is divided into 100-ft. strips and alternate strips are relamped, odd numbers being done first and evens afterwards. By the time the process is completed 4,000 hours has elapsed. This exceeds the allotted life of 3,000 hours to each lamp, but experience shows that in practice an average service life of 4,000 hours is attained. Each lamp is dated at the time of installation. When lamps burn out prematurely they are replaced and the new lamps dated. Such new lamps, however, are replaced in the routine servicing. If the dates indicate a substantial unused lighting efficiency they are placed in reserve for use in future emergency replacements corresponding to their useful life.

Illumination in Industry

Leading I.E.S. members took a prominent part in the Ophthalmological Congress held in Oxford during July 8 and 9. The discussion, on Thursday, July 8, on "Ophthalmic Education" was opened by Sir John Parsons, and on the following day the discussion on "Illumination in Industry" was opened by Sir Duncan Wilson, who was followed by Mr. H. C. Weston. It is very satisfactory to have this topic thus brought to the notice of ophthalmologists, whose co-operation in the problem of determining requisite lighting conditions is so much to be desired. We hope, shortly, to give fuller particulars of this event.

Lighting in the Aircraft Industry

The accounts of two recent lighting installations in aircraft works in this country given below may be regarded as complementary to the very large American installations discussed on pp. 98-99, and to the 50 ft.c. installation described in our last issue (p. 85). They illustrate what can be done in converting and improving existing installations—where possibilities are often more limited than in the case of a completely new works.

For the particulars of the redesigned lighting installation illustrated on this page we are indebted to the British Thomson-Houston Co., Ltd. In the drawing office (Fig. 1) the original general lighting was from 100 w. lamps in overhead conical shades, and was so inadequate that each board had to be provided with an adjustable arm bracket equipped with a 60 or 100 w. lamp. The new installation, comprising over 100 Mazda fluorescent lamps 9 ft. above floor level, furnishes 30-35 ft.-c. on the drawing board, with no evident shadows.

In Fig. 2 is shown the main bay, lighted by Mazda 1,000 w. gas-filled overhead units, again eliminating the need for local lighting. The building in which the main bays are situated was used in peace time for exhibitions, and is spacious and lofty. The original illumination did not exceed 3 ft.-c., and many portable lamps were needed in the three main bays. The new scheme, from units mounted 18 ft. high, gives 18 ft.-c., and only on rare occasions is a local lighting unit needed.

Fig. 1. The Drawing Office, where Mazda fluorescent lighting is now installed.

Fig. 2. One of the Main Bays lighted by 1,000 w. Mazda gasfilled lamps, eliminating the necessity for local units.

In the machine shop there has been a similar transformation, general lighting of 15 ft.-c. being provided. In the "view room," where small parts for aircraft are inspected, the original persistent trouble from specular glare has been removed by the use of fluorescent lamps, and in the sewing room—where glare, owing to light reflected from sewing machines and bright aluminium parts being covered with fabric, also gave trouble—the difficulty is no longer experienced with the new installation of Glassteel diffusers.

A second example is furnished by the General Electric Co., Ltd.—a recently completed lighting scheme comprising about 2,000 Osira h.p.m.v. discharge lamps for general illumination, augmented by Osram fluorescent tubes and tungsten dispersive and flameproof units.

Fig. 1. A section of the "black" inspection department, where a combination of fluorescent tubes and discharge lamps is used.

The original lighting, by tungsten lamps, was inadequate. To secure satisfactory conditions, still using tungsten lamps, would have meant an increase in running costs, trebling the lighting load, and heavy expenditure on new mains—the existing mains being already fully loaded. With a discharge lighting scheme on the other hand, only a slight increase over the present load need be undertaken, and the existing mains would answer.

A change over to discharge lamps was therefore agreed. In view of the variety of processes, involving much consideration of colours of material used, various lighting combinations were adopted. In the white shaping shops fluorescent discharge lamps were found most suitable, illuminations of the order of 10 to 15 ft.c. being provided. In one shop, where templates of black expanded rubber were made, shadowless illumination up to 35 ft.c. was achieved by a combination of general lighting from plain h.p.m.v. discharge lamps, with 5-ft. fluorescent tubes mounted 4 ft. above benches. Somewhat similar methods, furnishing 30 to 40 ft.c. on the working plane were adopted in the "black" inspection department (see Fig. 1), whereas discharge lamps were used exclusively in the "tipping" process (Fig 2).

Fig 2. A view of the shop devoted to "tipping," (i.e., fixing metal sheathing on the edges of airscrews), which is lighted by overhead discharge lamps.

During a trial installation of discharge lamps there were some comments by operatives on the stroboscopic effect. At the end of the period, however, they had become unconscious of it and were unanimously in favour of the new lighting conditions.

Foundry Lighting

A contribution by R. Rossiter to the I.E.S. "Lighting Review" (Australia) reminds us that good lighting is as necessary in the foundry as in any other "factory," though in legislation in factories a distinction was formerly drawn and there was a tendency to assume that a relatively low order of illumination would suffice. It is now recognised that illumination, so far from being prejudicial to the foundryman's operations (he was at one time assumed to prefer semi-darkness) has a definite bearing on the efficiency of work, besides being particularly expedient here in the interests of safety.

Several special features of foundry installations are, however, mentioned:

(1) The working plan is approximately at floor level—though some operations may be done several feet higher.

(2) The lighting should be so diffused as to penetrate into the interiors of moulds.

(3) The reflection factor is exceptionally low.

(4) Depreciation is very marked and may reach 50 per cent. in a few months unless care is taken to keep lamps and reflectors clean. Fittings should be, so far as possible, dust-proof and readily accessible.

(5) Owing to the varied nature of buildings used for moulding shops each installation requires individual treatment.

In the case quoted by Mr. Rossiter a general illumination at ground level of 12 ft.-c. was provided. Special fittings were also mounted on the underside of the crane so as to eliminate shadows otherwise caused thereby.

Lunch to Mr. G. Chelioti

The managements and senior executive staffs of the Osram-G.E.C. Lamp, Valve, and Glass Works, entertained Mr. George Chelioti to lunch at the Clarendon Restaurant, Hammersmith, on Wednesday, June 16, in celebration of his appointment to the board of the G.E.C. A reference to Mr. Chelioti's appointment appeared in our last issue (p. 84).

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THE VITAL IMPORTANCE OF LIGHTING. Throughout every stage of organised training, from "raw" recruits to skilled hands, lighting plays a vital part in achieving and maintaining full efficiency. Operatives can work better, more quickly, with less personal strain and consequently fewer accidents and "spoils," if they have really good seeing conditions.

A SCIENTIFIC PROBLEM. Good lighting is not simply a matter of increasing the number and power of the lamps. Lighting in industry is a scientific problem, and its correct solution not only increases efficiency, but may save power and therefore fuel. Lighting is a job for the expert.

AN ADVISORY SERVICE WITHOUT OBLIGATION. Those concerned in the lighting of factories are invited to make use of the Mazda Industrial Lighting Advisory Service which has been established for their assistance. Without obligation, a lighting specialist will examine and report on present lighting arrangements. He may confirm that they are correct, or be able to make suggestions which will result in increased efficiency, happier workers and higher output. You are invited to write for details.

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Traffic Control During Black-Outs*

A comparison of the above publication with similar literature in this country makes interesting reading. The specification comprises five sections, namely: (1) General; (2) Traffic Regulations; (3) Classification of Road Net; (4) Traffic Control Devices; and (5) Administration. In addition, there are appendices dealing with (a) Traffic markings; (b) Black-out traffic signs; (c) Black-out traffic signals; and (d) Summary of recommendations for black-out traffic control devices.

The measures specified are to be adopted in such areas as are prescribed by the proper authority. Designs of control devices can be approved by a testing laboratory accredited by the War Department, and a list of such laboratories has been prepared. Approved devices are indicated by a marking stating that the equipment is a War Department "Standard." (Practice in this respect resembles that frequently adopted in this country, e.g., in connection with fittings for war-time street lighting.)

The traffic regulations are of a very definite character, and the two following clauses may be quoted as of special interest:—

(a) No road user, except in emergency, shall move in a black-out unless his eyes are properly dark-adapted. At least five minutes in complete darkness is required after any exposure of the eyes to light intensities higher than those permissible during black-outs; and, whenever practicable, road users should remain in complete darkness for twenty to thirty minutes before moving in a black-out.

(b) Pedestrians should wear white or reflectorised leggings, anklets equipped with clear reflectors of approved type, white handkerchiefs tied around the lower portion of the legs, or other highly reflective leg bands, and should carry an approved black-out flashlight or lantern.

There are also detailed rules in regard to the speed of vehicles. It is stated that under black-out conditions a speed exceeding fifteen miles an hour will be deemed "unreasonable and imprudent." There are also limitations on overtaking and passing, turning round and parking. Pedestrians are enjoined not to walk on the travel portion of the roadway and to come to a stop before entering any roadway.

In Section 4, dealing with Traffic Control Devices, the marking of centre lines on roadways, all sorts of obstacles, kerbs, etc., in white is preferred. Reflecting devices may, however, be adopted where painting presents difficulty. It appears to have been concluded that luminescent materials are not in general satisfactory for use as traffic markings.

It is emphasised that ordinary untreated daylight signs are of little value for black-out purposes, and in the appendices suggestions for reflectorised and illuminated signs are made. At important points of traffic general street illumination may be required. This is defined in another special War Department specification.

In attempting to limit the brightness or conspicuousness of signs the method of stating that they shall be legible at a certain distance, but inconspicuous at a considerably greater one is adopted, as has been the case in this country. For example, it is stated that interior illuminated signs shall be legible to dark-adapted observers on a clear, moonless night at a distance of at least 100 ft., and shall not be detectable by such observers beyond 2,000 ft. Limiting values of brightness are, however, also given in some cases, e.g., 0.0016 to 0.0120 footlamberts (according to the area of the sign) are specified for the surface brightness of exterior illuminated signs.

Similarly, in an appendix dealing with Black-out Traffic Signals the candle-power to be emitted at various angles is specified, with a further proviso that the incident illumination on the street in front of any traffic signal operated during black-out shall not exceed 0.0016 ft.c. at street level.

* War Department Specification (OCD Publication 3,062, March, 1943). Issued by the U.S. Office of Civilian Defence.

Experiences with the "Dimout" in the United States

In a recent address published in *Illuminating Engineering* (May, 1943, page 251), Mr. S. G. Hibben, who is chairman of the Defence Committee of the Illuminating Engineering Society in America, reviews the problems involved in the Dimout in the United States.

This "Dimout" is applied mainly in coastal zones some thirty miles wide. The intention is somewhat different from that of the Blackout in this country, as the dimming of light serves chiefly to prevent the silhouette of ships being visible against lighted windows, or against the glow in the sky arising from public lighting, street signs, etc.

Mr. Hibben describes the proposed arrangements for dealing with traffic lights. The method of masking adopted is substantially similar to that used in this country. It is remarked that the noticeable range in darkness is several blocks of buildings, but in bright daylight rarely more than half a block. (This seems to demonstrate the wisdom of the new system recently introduced in London enabling *half* the luminous area to be exposed during daylight hours.)

It is estimated that roughly half the glow in the sky is caused by street lighting. The typical regulation indicates that :—

(a) Exposed sources and prominent reflections therefrom, shall not be visible from the sea.

(b) Street lights shall be reduced in wattage and number to the minimum consistent with their purpose and all street lights permanently shielded to prevent the source being visible above the horizontal.

(c) Street lighting, including the illumination of outdoor manufacturing, railroad yards, protective fence lighting, etc., shall be screened down to 45 degrees below the horizontal and held to a maximum of 1 ft.c. illumination on the ground.

The light from street lamps is limited chiefly by means of fibre cones, inserted under the reflectors, which reduces the cut-off angle to thirty degrees or more below the horizontal. A cut-away circular cylinder is also used to mask the light completely in directions facing the sea.

Methods of blacking-out portions of diffusing street lighting globes, having the same effect, are also illustrated. It is recognised as most difficult to ensure that *no* light travels upwards, but it is considered feasible to restrict the amount to less than 3 per cent. of the total.

In regard to window-covering materials, the ideal is that the material shall not emit more than 0.001 of 1 per cent. of the light behind them. In practice, however, such strictness does not seem to be usually necessary. Where the reduction of glow in the sky is the sole aim the regular roller blind or a closed Venetian blind, or other curtains having a low transmission will suffice—excepting those windows directly visible from the sea.

In the United States the difficulty experienced in this country of measuring such low orders of brightness has likewise been found. A new device, based on the comparison of the brightness of the object tested with that of a disc of radium-activated zinc sulphide or similar phosphorescent-fluorescent material, is now being investigated. A representative dark green roller blind may transmit 0.5 per cent. of light, and this is considered satisfactory for general purposes. In the case of shop windows the problem is rendered easier by the fact that most of the light is directed inwards and not on to the blinds. Therefore, materials having a normal transmission of as much as 30 to 40 per cent. may answer, provided the permissible maximum of 2 ft.c. received on a vertical plane parallel to, and 3 ft. from, the window glass, is not exceeded. Only in the case of the very best-lighted windows, with nearly white background, has it been found necessary to reduce the wattage of lamps used in the window.

In conclusion, Mr. Hibben emphasises that every solution of the Dimout problem is necessarily a compromise. "For safety and movement of war workers ashore, streets should be lighted. For safety of shipping they should not be. The proper middle course has evidently not been satisfactorily reached, but work continues."

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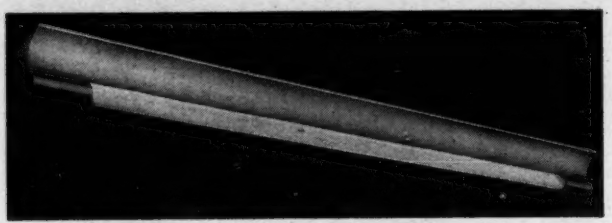

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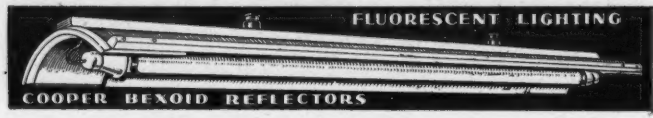

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Reviews of Books

The Place of Glass in Building. Edited by John Gloag. (Geo. Allen and Unwin, Ltd., London, 1943; pp. 90.)*

The new edition of this little work, first published in 1942, is welcome. Mr. Gloag, who contributes an introductory chapter on "The Place of Glass in Building," has assembled his matter in an up-to-date and readable form. Two architects (Messrs. Lionel B. Budden and G. A. Jellicoe) discuss the place of glass in architectural education and in connection with small standard houses, the latter making use of attractive thumbnail sketches. These introductory expositions serve to show how profoundly developments in glass may affect the design of buildings. (The phrase, "a wall of glass" is significant.) In what follows technical data are presented, the preparation of specifications is discussed, and a multitude of special glasses are described and illustrated. There are diagrams showing safe glazing sizes of sheet glass, particulars of toughened and armour plate-glass, and illustrations showing the application of such devices as glass bricks and "armourlight" glass lenses. The varieties of glass are legion. Vitrolite materials offer new possibilities in the way of decoration and display, vita glass admits u.v. radiation, whilst others are non-actinic; and it may be news to many that there are also varieties of amber glass, which discourage the entry of flies and insects. Helpful additions are a glossary of terms used in glazing and a brief, but useful, bibliography.

* Copies of this work have been presented to the I.E.S. Library.

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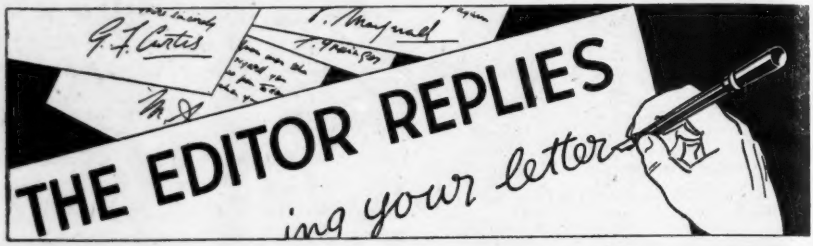
Benjamin Electric Discharge Fittings

We have received particulars of some additions to the range of Benjamin "X" type electric discharge reflectors. A number of new sizes has been added to the range, which is now complete in this type for 80-watt and 125-watt lamps, and for 80-watt fluorescent (high pressure) lamps. Reflectors are available in five principal patterns, dispersive, glassteel, parabolic angle, elliptical angle, and vertical elliptical, besides which reflectors are available for 80- and 125-watt lamps in porcelain well glass and concentrating patterns. The Benjamin standard construction, embodying cast iron flange and porcelain holder, is employed in all "X" type reflectors.

Mazda Lamps: War-Time Price List

We have received from the British Thomson Houston Company, Ltd., a copy of their recently-issued war-time Price List of Mazda lamps. In order to conserve vital materials and labour certain types and ratings of lamps have been withdrawn for the duration of the war. The list is therefore timely in showing which types are still available.



Mr. M. W. Hime (on whom the mantle of Mr. Howard Long seems to have alighted) has pointed out two definite errors in my remarks last month (p. 92). It was, of course, merely a momentary lapse that led to a reference to the present 4-ft. 80-watt **fluorescent lamp**—it should, of course, be **5 ft.**

Mr. Hime also reminds me that whilst the present 5-ft. fluorescent lamp has come to be associated mainly with industrial use, and since its appearance has been reserved mainly for factories engaged on national work, for which it is, indeed, well suited, it is not strictly correct to say that it was *designed* for industrial use. I understand that the length of 5 ft. was selected as being the smallest length compatible with maximum efficiency. After 5 ft. the efficiency curve becomes a straight line, but **tubes shorter than 5 ft. are less efficient**—though this may not ultimately be the case.

A second slip, due possibly to recent study of American literature, was the mention of 120 volts A.C. as a possible standard pressure. The **standard pressure** which is being aimed at in this country is **230 volts A.C., 50 cycles.** I recall that Mr. W. J. Jones, in his presidential address in 1941,* emphasised this. He exhibited a table showing that over 87 per cent. of lamps are sold at voltages between 170 and 260, and nearly 40 per cent. are sold for 230 volts—the desired future standard pressure.

There is a further point in connection with the **lighting of small rooms** on which I commented last month. Conditions in such rooms lend themselves well to the use of fittings with a semi-obscured surface, giving an agreeably low brightness but having an aperture below through which direct light is received. Such units may be very efficient as well as pleasing in appearance, but they are not so conveniently applied in large rooms where fittings are distributed at regular intervals and are most useful when the light is required mainly at some definite spot, e.g., a table in the centre of the room.

I have been asked to say something regarding **reflection of light from walls and ceilings.** When one considers that white blotting paper has a reflection factor of 80 per cent., one sees that a fresh white ceiling might be expected to furnish, say, 70 per cent. of light; 40 to 60 per cent. is not an unusual range of value for walls finished in light grey, buff or green. From a practical standpoint the reflection factor, even in the case of definite colours such as these, is not greatly affected by differences in the tints of ordinary incandescent sources yielding an approximation to " white " light, such as filament lamps or incandescent mantles. A fairly evident change in the tint of a light source can be produced without the total amount of light being very greatly altered. Sir William Abney once showed that the white light from an arc lamp can be converted into yellow by merely suppressing the blue component, which only furnished about half per cent. of the total luminosity. Such changes evidently have little effect on reflection factors. These remarks hold good for continuous spectra and for approximately

* Trans. Illum. Eng. Soc., Vol. VI., No. 9, Nov., 1941, p. 138.

"white" light. When we come to line spectra, such as those furnished by sodium and mercury discharge lamps, or to the spectra of sources equipped with highly coloured shades, the reflection factors of coloured walls may, of course, be very considerably affected.

My attention has been drawn to the vexed question whether, if artificial lighting is sufficiently good, **admission of daylight can be ignored?** Experience in factories working continuously by artificial light (see, for example, the description on pp. 98-99) shows that people can apparently manage quite well without daylight. Nevertheless, I think that most of us would still prefer a room into which real daylight enters, even if the temperature were less equable and the air-conditioning less perfect than in a controlled room with no windows, from which natural light was completely excluded.

Is **the daylight factor** a fair indication of admission of light into a building, even when the brightness of the sky is far from uniform? On the whole, I am inclined to think that it is so—though it is true that the *measurement* of daylight factors is naturally difficult, and perhaps impossible, when the distribution of brightness in the sky is continually varying. In Britain, where uniform white skies predominate, the value of the daylight factor as a criterion of admission of daylight is accepted. It has, however, been suggested that its value is somewhat impaired in countries where long periods of sunshine are usual and where the distribution of brightness in the sky differs substantially from that usual in this country.

Is **the use of dark glasses,** even in bright sunlight, expedient? It is surely questionable whether such glasses are needed for people with normal vision in British sunshine, though they may, of course, prove valuable in the glare of the tropics. The demand for them comes, perhaps, from those who are addicts of sun-bathing and may spend some time lying on their backs looking upward at the sky. Possibly, however, fashion in some degree accounts for their use by people merely walking about.

It is plain that in such matters as these misconceptions easily arise. I recall that **during the last total eclipse** visible in this country, people were warned, in the daily Press, not to look straight at the sun without the protection of dark glasses. This was apparently interpreted to mean that there was something dangerous about the light of the sun during the eclipse period. I recall the amusing spectacle, when preparing to view the eclipse in the north of England, of processions of people wearing dark glasses, though the sky was overcast and the light was poor, even before the eclipse began. As events proved, it was only in rare cases that a direct glimpse of the sun was secured on that occasion.

Mr. George Ainsworth, in a recent letter from America, comments sympathetically on Mr. Weston's paper on **"Proposals for a New Lighting Code."** He suggests, however, that "it would seem beyond the function of the law to make management responsible for doing work as fast as possible by specifying 90 per cent. optimum visual acuity." This is quite a fair comment. I think, however, that legal standards are not really dependent on performance of work, but on the recognition that inadequate lighting *does* occasion fatigue and imposes handicaps on the work of the worker which may affect his health —even though admittedly this is most difficult to prove.

Mr. Ainsworth also contends, quite rightly, that values of "legal footcandles" on the work are not alone sufficient, and that attention must also be devoted to the elimination of glare and other troublesome conditions. This, he contends, can best be secured by obtaining what he describes as **"Brightness Equilibrium."** The difficulty at present is to define exactly what is understood by this term and to specify simple conditions which will ensure that the quality of light, as well as the quantity, is what the situation demands.

Literature on Lighting

(Abstracts of Recent Articles on Illumination and Photometry in the Technical Press)

(Continued from p. 78, May, 1943)

INSTRUMENTS

40. Slotted Cylindrical Rotors for Photometric Calibration. Platt, Clark, Cohen and Caldwell. Review of Scientific Instruments. Vol. 14, No. 4. Design data are given for building hollow cylindrical rotors with slotted walls which can be used as substitutes for sector discs in some photometric applications. They have been found to be particularly useful in vacuum spectrophotometry. W. E. H.

41. Photoelectric Glossmeter. Anon. Review of Scientific Instruments. Vol. 14, No. 4. This instrument is designed to measure the specular gloss of paints or polished surfaces. Collimated incident light falls on the surface under test at 60 deg., and the amount reflected at the specular angle is recorded by a photocell, the instrument being calibrated in terms of polished black glass. W. E. H.

SOURCES OF LIGHT AND MATERIAL

42. Group Replacement of Fluorescent Lamps. H. Reinhardt. Am. Illum. Eng. Soc., Trans., pp. 179-188, April, 1943. The economics of group replacement of fluorescent lamps are given, so far as is possible when only the general care can be considered. J. S. S.

43. Cold-Cathode Fluorescent at War. J. C. Sabatini. Am. Illum. Eng. Soc. Trans., pp. 171-178, April, 1943. A description is given of a large high-voltage cold cathode fluorescent lighting installation in a factory. Particular reference is made to methods of overcoming the scarcity of certain materials. J. S. S

44. Study in Photo-luminescence in Glass. A. R. Rodriguez, C. W. Parmelee, and A. E. Badger. Journal of the American Ceramic Society. Vol. 26, No. 5. The results of a detailed investigation of the influence of temperature and composition on the fluorescence of uranium and other glasses. W. E. H.

APPLICATIONS OF LIGHT

45. Modern Lighting Practice. Anon. Am. Illum. Eng. Soc., Trans., pp. 167-170, April, 1943. Some representative lighting schemes are described with photographs. J. S. S.

46. A Summary of Researches in Seeing at Low Brightness Levels. M. Luckeish and A. H. Taylor. Am. Illum. Eng. Soc. Trans., pp. 189-207, April, 1943. A summary of work done by the authors during the last two years: dark adaptation and visual acuity under coloured light are discussed in some detail. J. S. S.

47. Fifty Ft.-Candle Industrial Lighting. Anon. Electrical Times. Vol. 103, No. 2,695, June 17, 1943. A description is given of a fluorescent tube installation in a factory manufacturing small and intricate mechanisms. Twin tube circuits in continuous troughing are employed and an illumination of 50 ft.c. on the working plane is obtained. W. E. H.

48. Correct Lighting Protects Against Sabotage. C. Ainsworth. Industrial Standardisation, February, 1943, pp. 40-37-39. The author describes, with illustrations, the protective lighting being adopted in the U.S.A. with a view to preventing sabotage. The system may be adopted to define boundaries as well as illuminating areas sufficiently strong to prevent the approach of unauthorised persons. Minimum levels of illumination are recommended, but, it is emphasised, are not necessarily sufficient for carrying out night work. "Protective Lighting" and "Dimout Lighting" are in conflict one with another, and in dimout areas the advice of authorities must be sought. J. S. D.